

## SEARCH REPORT

### APPARATUS FOR INTRODUCING GRANULAR MOLD FLUX ONTO THE TOP OF SLAB WITHIN CONTINUOUS CASTING MOLD

It is customary to apply a mold flux, which may be a powder or granular material, onto the top of a slab during continuous casting as shown in U.S. 4,084,626. In practice, it is desirable to have about 1 - 3 inches of flux on top of the mold during casting. The device illustrated in the foregoing patent is for feeding a mold flux in the form of a powder. The powder has poor flow characteristics, and thus a screw feed mechanism is used, which screw extends between an intermediate hopper (or bin) and the top of the slab. This form of device is somewhat expensive and, in fact, is not typically used in industry because of its cost and unreliable operation. Thus, it is common today to merely sweep the mold flux onto the top of the slab when desired, the flux being provided in 20 kg. bags.

A granular mold flux has been developed which has good flow characteristics. An apparatus has been developed which takes advantage of the good flow characteristics, the apparatus consisting of a vacuum transfer system which transfers the granular mold flux from a large bulk bag (approximately 4 - 5 ft. on each side) to an intermediate hopper provided with a sensor a suitable distance above the bottom of the intermediate hopper, the intermediate hopper being mounted on a side of a tundish. If the sensor is covered with flux, the vacuum transfer system will be turned off; but when the sensor is uncovered, the transfer system will be turned on to refill the intermediate hopper until the sensor is again covered. From the intermediate hopper, the flux will flow by gravity through a pair of tubes onto the top of the slab being cast. It has been found that satisfactory flow will be achieved if the diameter of each delivery tube is at least 1 inch. However, it is necessary to control the flow rate of the flux being delivered to that of the flux which is being consumed. This is done by pneumatically operated pinch valves, each valve being located in a delivery tube. The orifice size of the valve is controlled by an operator via a control device, and in opera-

tion, the operator will set the control for the desired flow rate. If it is not right, as will be determined via a visual inspection of the top of the slab, it will be adjusted.

A search was conducted in the United States Patent Office in Class 164, subclasses 268, 470, 472, and 473 (U.S. and foreign) and in Class 222, subclasses 64 and 527 (U.S. only). The following art was noted:

3,900,065	Giunta et al.	Aug. 19, 1975
4,084,628	Schmid	Apr. 18, 1978
4,116,367	Kataoka et al.	Sep. 26, 1978
4,595,045	Mangin et al.	Jun. 17, 1986
5,158,129	Hubert et al.	Oct. 27, 1992

#### FOREIGN PATENTS

1,474,697	French	Feb. 1967
2,407,773	French	July 1979
2,635,029	French	Feb. 1990
2,321,847	German	Nov. 1974
49-37893	Japanese	Oct. 1974

Hubert discloses a device for feeding powdered or granular material into a continuous casting mold consisting of a primary hopper 13, a secondary hopper 18, a delivery tube 10, and an intermediate tube 15 between the primary and secondary hoppers. The intermediate delivery tube 15 is provided with sensors, either 16 or 18, which are utilized to turn a valve open or closed.

German ('847) discloses a flux adding system using two hoppers 12 and 18. Inert gas is used to push the material (iron powder) through a tube 20.

French ('029) discloses adding flux material to a slab or the top of an ingot in a continuous caster from a hopper 8. The material is moved through pipe 9 under the influence of a vibrator 11. A regulating valve 10 is used to input a control system (not shown) to control the vibrator.

French ('773) discloses a flux feeding system which also relies on moving the material through tube 50 by vibration thereof.

French ('697) discloses a system to charge slag material to the top of an ingot mold wherein a reducing gas is used to

transport the material through pipe 11.

Japanese ('893) discloses a system which uses a gas to blow the flux material into the ingot mold or melt. The feeding tubes or hoses include flexible section 8. The valve 9 controls the material flow.

Kataoka discloses an apparatus in which the material to be added to an ingot top is charged by using a pneumatic powder-conveyor.

The remaining patents are cited to further show the state of the art.

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